Fig. 1

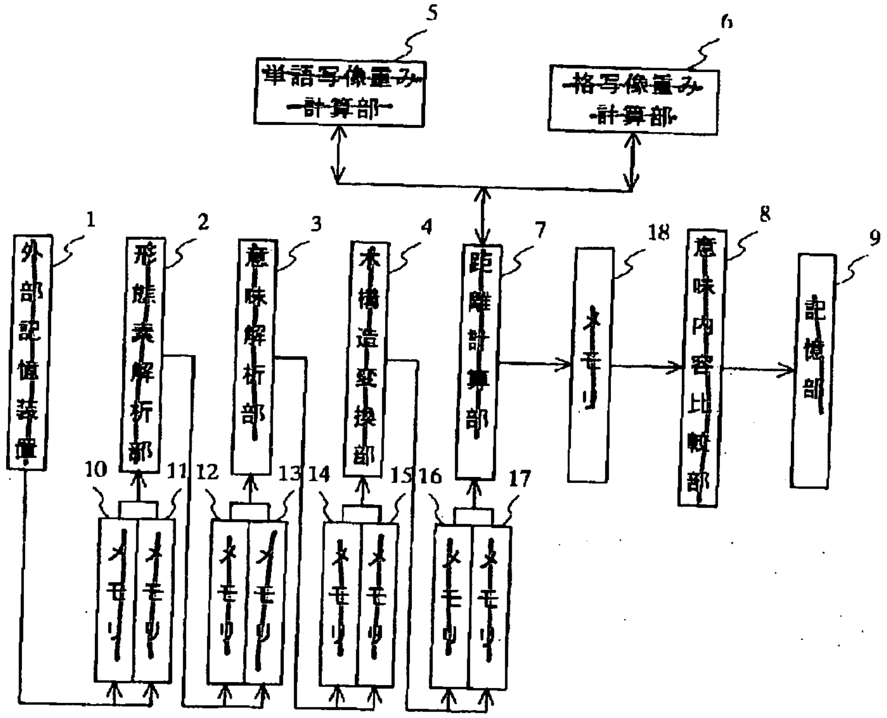

5
~~単語写像重み計算部~~
6
~~格写像重み計算部~~
1
~~外部記憶装置~~
2
~~形態素解析部~~
3
~~意味解析部~~
4
~~木構造変換部~~
7
~~距離計算部~~
18
~~メモリ~~
8
~~意味内容比較部~~
9
~~記憶部~~
10
11
12
13
14
15
16
17
~~メモリ~~
~~メモリ~~
~~メモリ~~
~~メモリ~~
~~メモリ~~
~~メモリ~~
~~メモリ~~
~~メモリ~~

Fig. 2

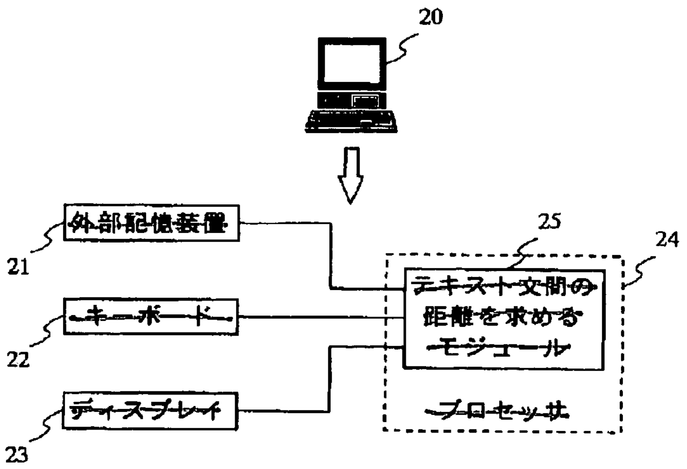

20
~~外部記憶装置~~
21
~~キーボード~~
22
~~ディスプレイ~~
23
25
24
~~テキスト文間の距離を求めるモジュール~~
~~プロセッサ~~

Fig. 1

1	external storage apparatus
2	morphological analysis section
3	semantic analysis section
4	tree structure conversion section
5	word-mapping-weight calculation section
6	case-mapping-weight calculation section
7	distance calculation section
8	semantic content comparison section
9	storage section
10~18	memory

Fig. 2

21	external storage apparatus
22	keyboard
23	display
24	processor unit
25	module for obtaining distance between text sentences

Fig.3

A/DT teacher/NN teaches/VBZ English/NNP to/TO students/NNS

Where, DT indicates Determiner, NN indicates Noun(singular or mass),
VBZ indicates Verb(3rd ps. sing. Present), NNP indicates Proper noun(singular),
TO indicates to, and NNS indicates Noun(plural).

~~Fig. 3~~

~~先生~~	~~先生~~	~~センセイ~~	~~センセイ~~	~~名詞－一般~~		
~~は~~	~~は~~	~~ハ~~	~~ワ~~	~~助詞－係助詞~~		
~~生徒~~	~~生徒~~	~~セイト~~	~~セイト~~	~~名詞－一般~~		
~~に~~	~~に~~	~~ニ~~	~~ニ~~	~~助詞－格助詞－一般~~		
~~英語~~	~~英語~~	~~エイゴ~~	~~エイゴ~~	~~名詞－一般~~		
~~を~~	~~を~~	~~ヲ~~	~~ヲ~~	~~助詞－格助詞－一般~~		
~~教える~~	~~教える~~	~~オシエル~~	~~オシエル~~	~~動詞－自立~~	~~一段~~	~~基本形~~
~~EOS~~						

Fig. 4

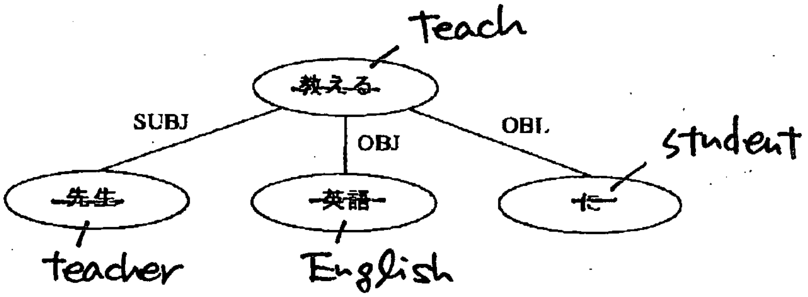
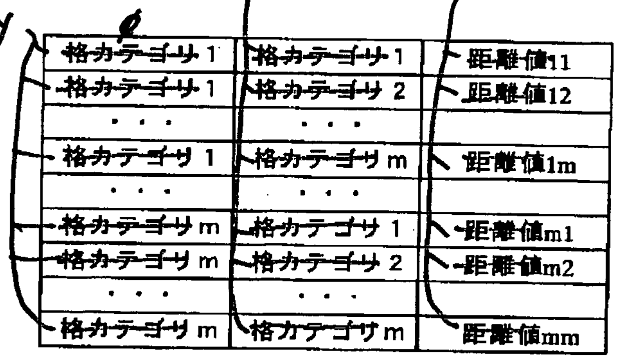

Teach
~~教える~~
SUBJ
OBJ
OBL
student
~~先生~~
~~英語~~
~~に~~
teacher
English

Fig. 5



case category	case category	distance value
~~格カテゴリ~~ 1	~~格カテゴリ~~ 1	~~距離値~~11
~~格カテゴリ~~ 1	~~格カテゴリ~~ 2	~~距離値~~12
・・・	・・・	
~~格カテゴリ~~ 1	~~格カテゴリ~~ m	~~距離値~~1m
・・・	・・・	
~~格カテゴリ~~ m	~~格カテゴサ~~ 1	~~距離値~~m1
~~格カテゴリ~~ m	~~格カテゴリ~~ 2	~~距離値~~m2
・・・	・・・	
~~格カテゴリ~~ m	格カテゴサ m	距離値mm

Fig. 6A

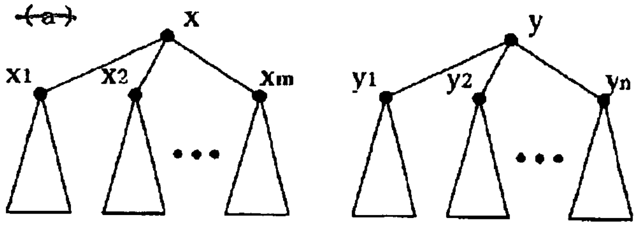

~~(a)~~
x
x_1
x_2
x_m
y
y_1
y_2
y_n

Fig. 6B

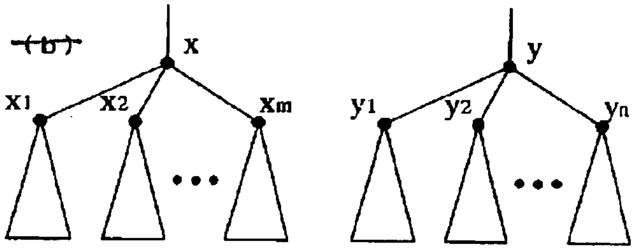

~~(b)~~
x
x_1
x_2
x_m
y
y_1
y_2
y_n

Fig. 6C

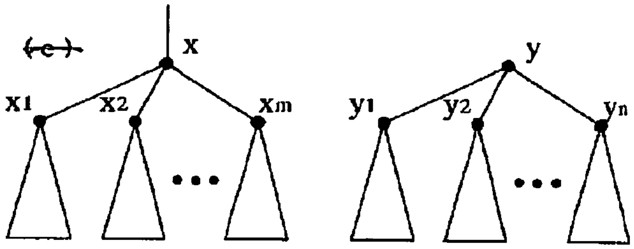

~~(c)~~
x
x_1
x_2
x_m
y
y_1
y_2
y_n

Fig. 6D

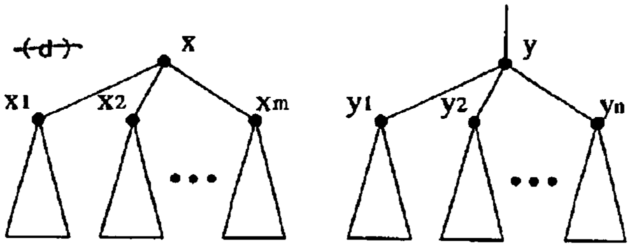

~~(d)~~
x
x_1
x_2
x_m
y
y_1
y_2
y_n

Fig. 7

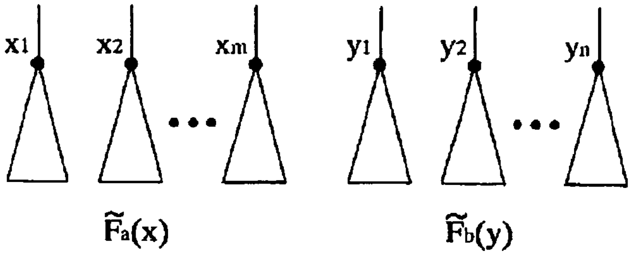

x1
x2
xm
y1
y2
yn
$\widetilde{F}_a(x)$
$\widetilde{F}_b(y)$

Fig. 8

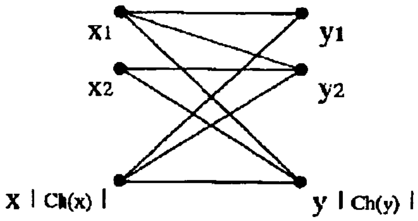

x1
x2
x | Ch(x) |
y1
y2
y | Ch(y) |

Fig. 9 A

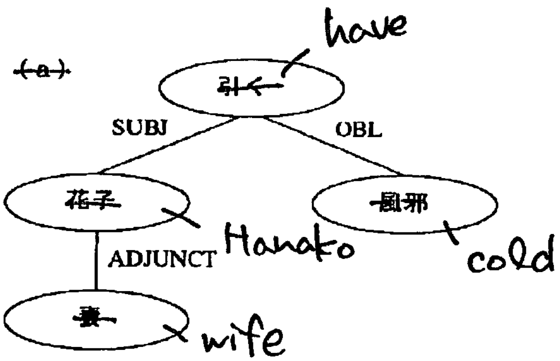

~~(a)~~
~~引く~~
have
SUBJ
OBL
~~花子~~
Hanako
~~風邪~~
cold
ADJUNCT
~~妻~~
wife

Fig. 9B

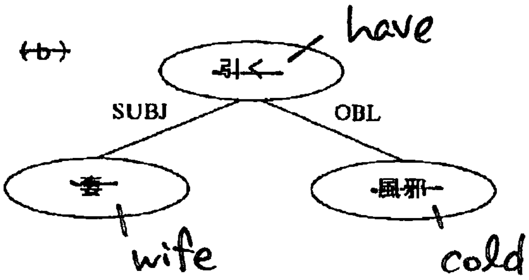
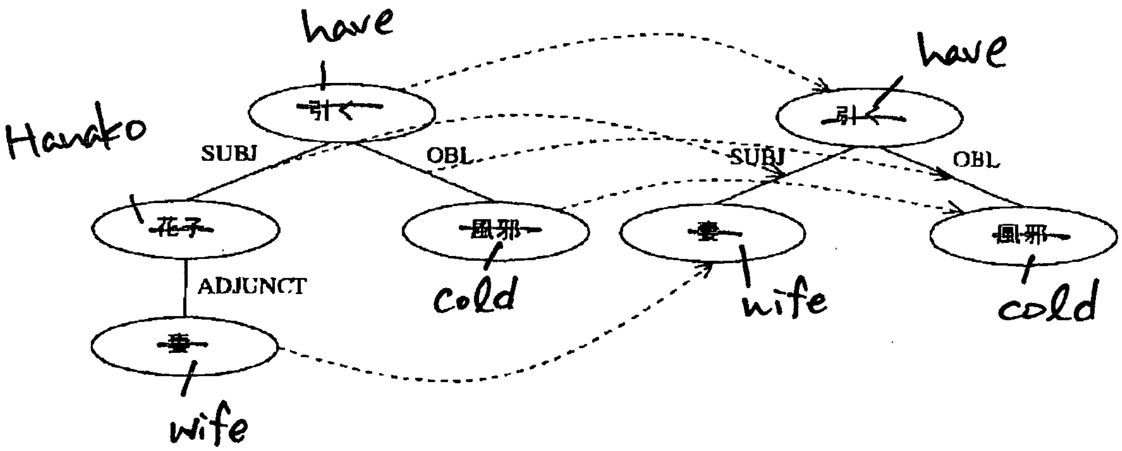
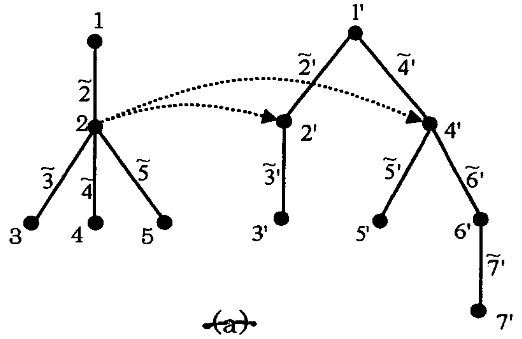

~~(b)~~
~~引く~~
have
SUBJ
OBL
~~妻~~
wife
~~風邪~~
cold

Fig. 10



have
~~引く~~
Hanako
SUBJ
OBL
~~花子~~
~~風邪~~
cold
ADJUNCT
~~妻~~
wife
have
~~引く~~
SUBJ
OBL
~~妻~~
wife
~~風邪~~
cold

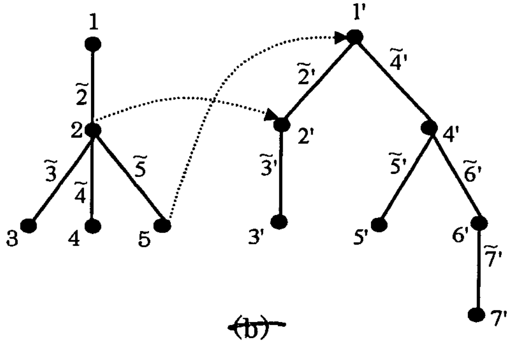
Fig. 11A



1
2̃
2
3̃
4̃
5̃
3
4
5
1'
2̃'
4̃'
2'
4'
3̃'
5̃'
6̃'
3'
5'
6'
7̃'
7'

~~(a)~~

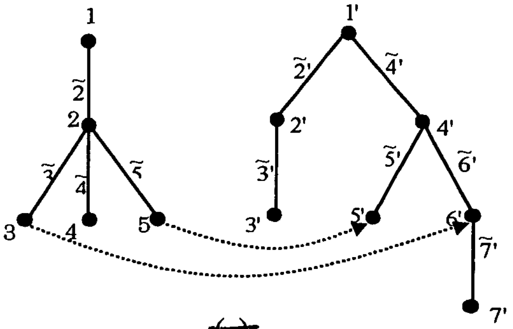
Fig. 11B



1
2̃
2
3̃
4̃
5̃
3
4
5
1'
2̃'
4̃'
2'
4'
3̃'
5̃'
6̃'
3'
5'
6'
7̃'
7'

~~(b)~~

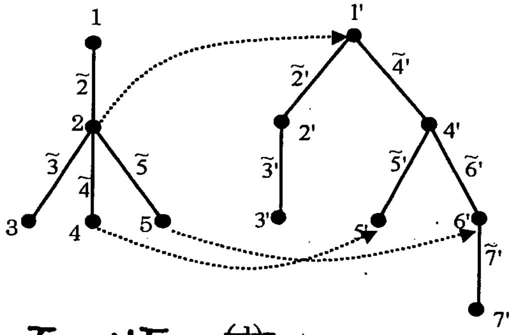
Fig. 11C



1
2̃
2
3̃
4̃
5̃
3
4
5
1'
2̃'
4̃'
2'
4'
3̃'
5̃'
6̃'
3'
5'
6'
7̃'
7'

~~(c)~~

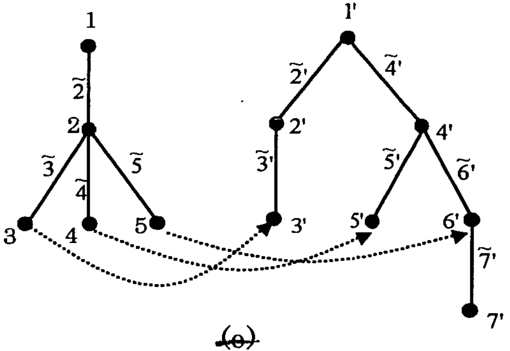
Fig. 11D



1
2̃
2
3̃
4̃
5̃
3
4
5
1'
2̃'
4̃'
2'
4'
3̃'
5̃'
6̃'
3'
5'
6'
7̃'
7'

~~(d)~~

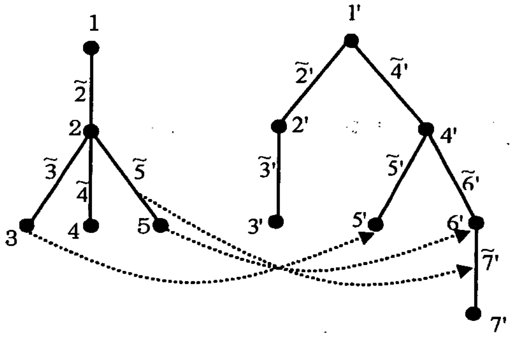
Fig. 11E



1
2̃
2
3̃
4̃
5̃
3
4
5
1'
2̃'
4̃'
2'
4'
3̃'
5̃'
6̃'
3'
5'
6'
7̃'
7'

~~(e)~~

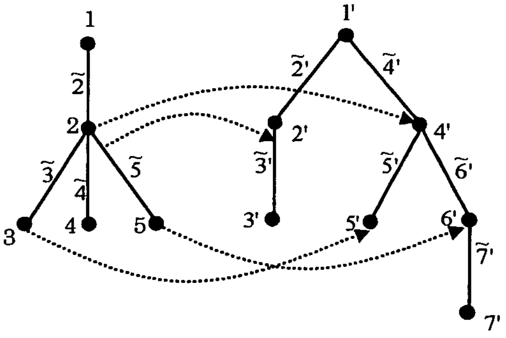
Fig. 11F



1
2̃
2
3̃
4̃
5̃
3
4
5
1'
2̃'
4̃'
2'
4'
3̃'
5̃'
6̃'
3'
5'
6'
7̃'
7'

~~(f)~~

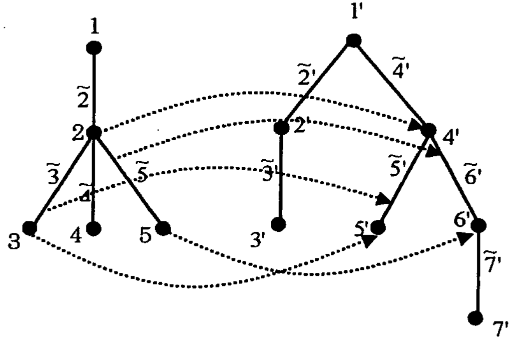
Fig. 11G



1
2̃
2
3̃
4̃
5̃
3
4
5
1'
2̃'
4̃'
2'
4'
3̃'
5̃'
6̃'
3'
5'
6'
7̃'
7'

~~(g)~~

Fig. 11H



1
2̃
2
3̃
4̃
5̃
3
4
5
1'
2̃'
4̃'
2'
4'
3̃'
5̃'
6̃'
3'
5'
6'
7̃'
7'

~~(h)~~

Fig. 12

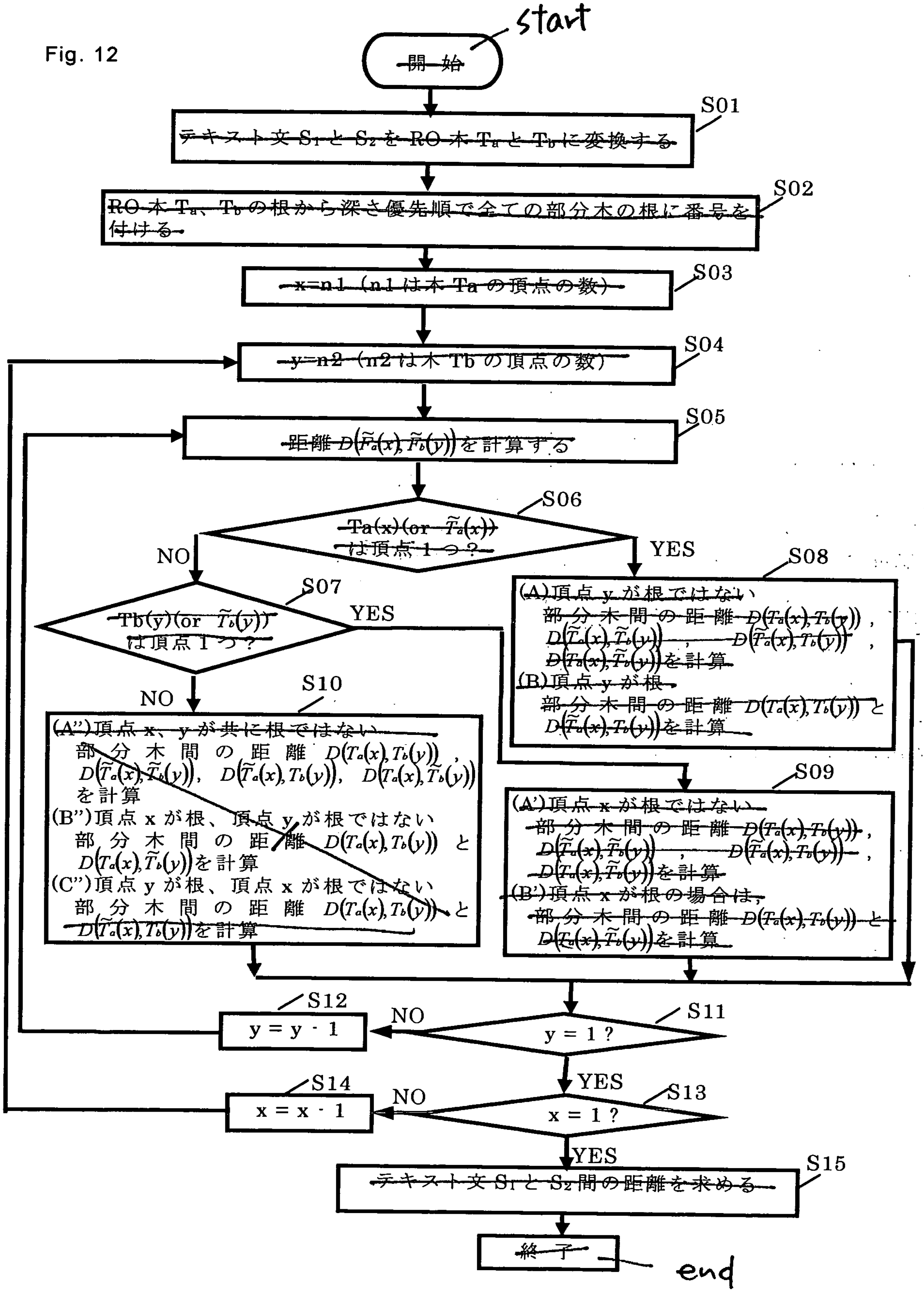

start
~~開始~~
S01
~~テキスト文 S_1 と S_2 を RO 木 T_a と T_b に変換する~~
S02
~~RO 木 T_a、T_b の根から深さ優先順で全ての部分木の根に番号を付ける~~
S03
~~x=n1（n1 は木 Ta の頂点の数）~~
S04
~~y=n2（n2 は木 Tb の頂点の数）~~
S05
~~距離 $D(\tilde{F}_a(x),\tilde{F}_b(y))$ を計算する~~
S06
~~Ta(x)(or $\tilde{T}_a(x)$) は頂点 1 つ？~~
NO
YES
S07
~~Tb(y)(or $\tilde{T}_b(y)$) は頂点 1 つ？~~
YES
NO
S08
~~(A)頂点 y が根ではない~~
~~部分木間の距離 $D(T_a(x),T_b(y))$, $D(\tilde{T}_a(x),\tilde{T}_b(y))$, $D(\tilde{T}_a(x),T_b(y))$, $D(T_a(x),\tilde{T}_b(y))$ を計算~~
~~(B)頂点 y が根~~
~~部分木間の距離 $D(T_a(x),T_b(y))$ と $D(\tilde{T}_a(x),T_b(y))$ を計算~~
S10
~~(A”)頂点 x、y が共に根ではない~~
部分木間の距離 $D(T_a(x),T_b(y))$, $D(\tilde{T}_a(x),\tilde{T}_b(y))$, $D(\tilde{T}_a(x),T_b(y))$, $D(T_a(x),\tilde{T}_b(y))$ を計算
(B”)頂点 x が根、頂点 y が根ではない
部分木間の距離 $D(T_a(x),T_b(y))$ と $D(T_a(x),\tilde{T}_b(y))$ を計算
(C”)頂点 y が根、頂点 x が根ではない
部分木間の距離 $D(T_a(x),T_b(y))$ と ~~$D(\tilde{T}_a(x),T_b(y))$ を計算~~
S09
~~(A’)頂点 x が根ではない~~
~~部分木間の距離 $D(T_a(x),T_b(y))$, $D(\tilde{T}_a(x),\tilde{T}_b(y))$, $D(\tilde{T}_a(x),T_b(y))$, $D(T_a(x),\tilde{T}_b(y))$ を計算~~
~~(B’)頂点 x が根の場合は、~~
~~部分木間の距離 $D(T_a(x),T_b(y))$ と $D(T_a(x),\tilde{T}_b(y))$ を計算~~
S12
y = y - 1
NO
S11
y = 1 ?
YES
S14
x = x - 1
NO
S13
x = 1 ?
YES
S15
~~テキスト文 S_1 と S_2 間の距離を求める~~
~~終了~~
end

Fig. 12

S01 convert text sentences S1 and S2 into RO trees Ta and Tb

S02 allotting numbers to roots of all subtrees of the RO trees Ta and Tb in depth first order from root of the RO tree

S03 x = n1 where n1 denotes number of vertexes in the tree Ta

S04 y = n2 where n2 denotes number of vertexes in the tree Tb

S05 calculate a distance $D(\tilde{F}_a(x), \tilde{F}_b(y))$

S06 Does $T_a(x)$ (or $\tilde{T}_a(x)$) consist of one vertex?

S07 Does $T_b(y)$ (or $\tilde{T}_b(y)$) consist of one vertex?

S08 (A) vertex y is not root

Calculate distances between subtrees $D(T_a(x), T_b(y))$, $D(\tilde{T}_a(x), \tilde{T}_b(y))$, $D(\tilde{T}_a(x), T_b(y))$, and $D(T_a(x), \tilde{T}_b(y))$.

(B) vertex y is root

calculate distances between subtrees $D(T_a(x), T_b(y))$ and $D(\tilde{T}_a(x), T_b(y))$

S09 (A) vertex x is not root

Calculate distances subtrees $D(T_a(x), T_b(y))$, $D(\tilde{T}_a(x), \tilde{T}_b(y))$, $D(\tilde{T}_a(x), T_b(y))$, and $D(T_a(x), \tilde{T}_b(y))$

(B) vertex x is root

Calculate distances subtrees $D(T_a(x), T_b(y))$ and $D(T_a(x), \tilde{T}_b(y))$

S10 (A) vertexes x and y are not root

Calculate distances between subtrees $D(T_a(x), T_b(y))$, $D(\tilde{T}_a(x), \tilde{T}_b(y))$, $D(\tilde{T}_a(x), T_b(y))$, and $D(T_a(x), \tilde{T}_b(y))$

(B) vertex x is root and vertex y is not root

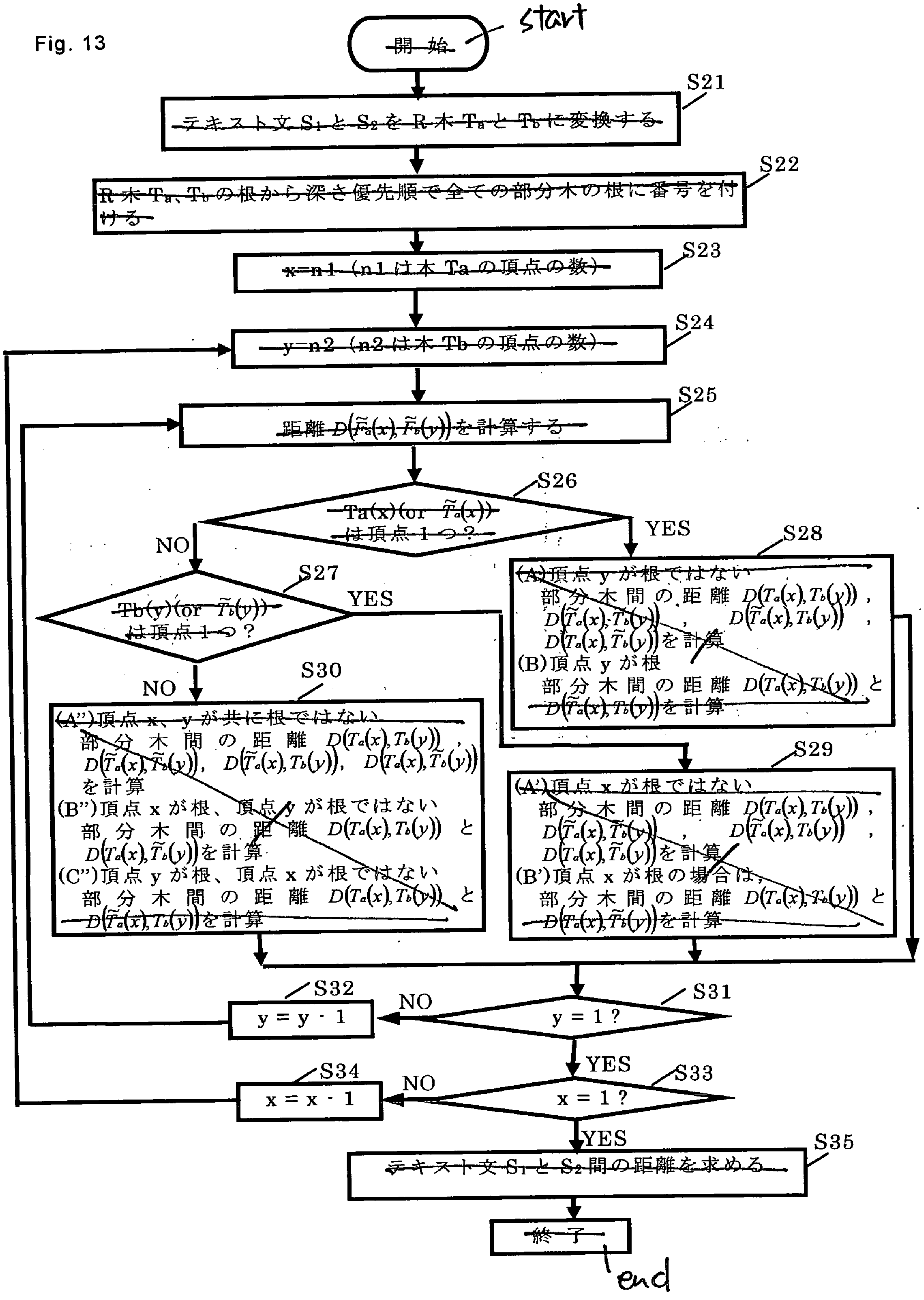
Calculate distances subtrees $D(T_a(x), T_b(y))$ and $D(T_a(x), \tilde{T}_b(y))$

(C) vertex x is not root and vertex y is root

calculate distances between subtrees $D(T_a(x), T_b(y))$ and $D(\tilde{T}_a(x), T_b(y))$

S15 calculate distance between the text sentences S1 and S2

Fig. 13



~~開 始~~
start
S21
~~テキスト文 S_1 と S_2 を R 木 T_a と T_b に変換する~~
S22
~~R 木 T_a、T_b の根から深さ優先順で全ての部分木の根に番号を付ける~~
S23
~~x=n1（n1 は木 Ta の頂点の数）~~
S24
~~y=n2（n2 は木 Tb の頂点の数）~~
S25
~~距離 $D(\tilde{F}_a(x), \tilde{F}_b(y))$ を計算する~~
S26
~~Ta(x)(or $\tilde{T}_a(x)$) は頂点 1 つ？~~
YES
NO
S27
~~Tb(y)(or $\tilde{T}_b(y)$) は頂点 1 つ？~~
YES
NO
S28
~~(A)頂点 y が根ではない~~
部分木間の距離 $D(T_a(x), T_b(y))$，$D(\tilde{T}_a(x), T_b(y))$，$D(\tilde{T}_a(x), T_b(y))$，$D(T_a(x), \tilde{T}_b(y))$ を計算
(B)頂点 y が根
部分木間の距離 $D(T_a(x), T_b(y))$ と
~~$D(\tilde{T}_a(x), T_b(y))$ を計算~~
S30
~~(A'')頂点 x、y が共に根ではない~~
部分木間の距離 $D(T_a(x), T_b(y))$，$D(\tilde{T}_a(x), \tilde{T}_b(y))$，$D(\tilde{T}_a(x), T_b(y))$，$D(T_a(x), \tilde{T}_b(y))$ を計算
(B'')頂点 x が根、頂点 y が根ではない
部分木間の距離 $D(T_a(x), T_b(y))$ と $D(T_a(x), \tilde{T}_b(y))$ を計算
(C'')頂点 y が根、頂点 x が根ではない
部分木間の距離 $D(T_a(x), T_b(y))$ と
~~$D(\tilde{T}_a(x), T_b(y))$ を計算~~
S29
~~(A')頂点 x が根ではない~~
部分木間の距離 $D(T_a(x), T_b(y))$，$D(\tilde{T}_a(x), \tilde{T}_b(y))$，$D(\tilde{T}_a(x), T_b(y))$，$D(T_a(x), \tilde{T}_b(y))$ を計算
(B')頂点 x が根の場合は，
部分木間の距離 $D(T_a(x), T_b(y))$ と
~~$D(T_a(x), \tilde{T}_b(y))$ を計算~~
S32
y = y - 1
NO
S31
y = 1 ?
YES
S34
x = x - 1
NO
S33
x = 1 ?
YES
S35
~~テキスト文 S_1 と S_2 間の距離を求める~~
~~終 了~~
end

Fig. 13

S21 convert text sentences S1 and S2 into R trees Ta and Tb

S22 allotting numbers to roots of all subtrees of the R trees Ta and Tb in depth first order from root of the R tree

S23 x = n1 where n1 denotes number of vertexes in the tree Ta

S24 y = n2 where n2 denotes number of vertexes in the tree Tb

S25 calculate a distance $D(\tilde{F}_a(x), \tilde{F}_b(y))$

S26 Does $T_a(x)$ (or $\tilde{T}_a(x)$) consist of one vertex?

S27 Does $T_b(y)$ (or $\tilde{T}_b(y)$) consist of one vertex?

S28 (A) vertex y is not root

Calculate distances between subtrees $D(T_a(x), T_b(y))$, $D(\tilde{T}_a(x), \tilde{T}_b(y))$, $D(\tilde{T}_a(x), T_b(y))$, and $D(T_a(x), \tilde{T}_b(y))$

(B) vertex y is root

calculate distances between subtrees $D(T_a(x), T_b(y))$ and $D(\tilde{T}_a(x), T_b(y))$

S29 (A) vertex x is not root

Calculate distances subtrees $D(T_a(x), T_b(y))$, $D(\tilde{T}_a(x), \tilde{T}_b(y))$, $D(\tilde{T}_a(x), T_b(y))$, and $D(T_a(x), \tilde{T}_b(y))$

(B) vertex x is root

Calculate distances subtrees $D(T_a(x), T_b(y))$ and $D(T_a(x), \tilde{T}_b(y))$

S30 (A) vertexes x and y are not root

Calculate distances between subtrees $D(T_a(x), T_b(y))$, $D(\tilde{T}_a(x), \tilde{T}_b(y))$, $D(\tilde{T}_a(x), T_b(y))$, and $D(T_a(x), \tilde{T}_b(y))$

(B) vertex x is root and vertex y is not root

Calculate distances subtrees $D(T_a(x), T_b(y))$ and $D(T_a(x), \tilde{T}_b(y))$

(C) vertex x is not root and vertex y is root

calculate distances between subtrees $D(T_a(x), T_b(y))$ and $D(\tilde{T}_a(x), T_b(y))$

S35 calculate distance between the text sentences S1 and S2